
EXHIBIT 21

Final Report

Pilot Test of Water Treatment Technologies

Valley Water Management Company

Fee 34 Facility

Edison, California

October 19, 2016

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Section 1: Introduction

Valley Water Management Company ("Valley Water") operates two facilities in the Edison Oil Field near the unincorporated community of Edison, California (Figure 1). The first facility, known as "Fee 34" (Figure 2), treats produced water from several local oil producers in a series of ponds. This water is then pumped to the second facility, known as "Race Track Hill." At the Race Track Hill Facility, additional ponds store produced water and this water is used to irrigate to five areas of grasses, desert shrubs, and salt tamarisk trees using pumps and sprinklers. Together, these facilities have been in continuous operation for over fifty years.

In May 2016, as part of a Proposition 65 settlement agreement, Valley Water consented to implement a single 60-day pilot test at the Fee 34 Facility of a multi-step produced water treatment system that culminates in reverse osmosis. The agreement carried the following stipulations:

1. The pilot treatment system would be designed and installed with the intent that the treated water would meet or be below Proposition 65 safe harbor levels and any applicable Regional Water Control Board Basin Plan objectives for the Proposition 65 notice's constituents (i.e., benzene, toluene, ethylbenzene, and naphthalene), herein collectively called the "Effluent Specifications" (Table 1).
2. The pilot test would begin no later than July 20, 2016, and the results would be monitored periodically for compliance with the Effluent Specifications.
3. Valley Water would provide a report to the Plaintiffs on the effectiveness of the pilot test no later than October 20, 2016.

In compliance with the agreement, on July 20, 2016, Valley Water commenced a pilot test at the Fee 34 Facility of a multi-step produced water treatment system provided by ECT (EnviroClean Technologies). Then, on July 28, 2016, Valley Water commenced a second pilot test at the same facility of a multi-step produced water treatment system provided by AGT (Absolute Graphic Technologies) Water Systems. Both systems culminate in reverse osmosis. Data from one of these facilities was provided to the plaintiffs per the terms of the settlement agreement.

After an initial start-up and commissioning period, both pilot facilities have demonstrated the ability to consistently treat the produced water to below the limits contained in the Effluent Specifications.

Section 2: Technology Selection

In 2015, Valley Water Management Company reviewed several water treatment technologies that could treat Edison produced water to below the limits set forth in the Effluent Specifications (Table 1).

The first technology to be evaluated was the OPUS™ process, which uses a chemical coagulation process in conjunction with high pH reverse osmosis membranes to remove key contaminants such as dissolved solids, boron, and organic compounds. The OPUS™ process is marketed by Veolia Water, and was evaluated first because this technology has been proven commercially in two California oil fields with produced water qualities similar to the Edison Field.

However, the OPUS™ process was eliminated from consideration due to very high operating and capital costs, estimated at \$0.40 to \$0.60/bbl (\$3,100 to \$4,700 per acre-foot) of treated water. These costs are largely due to the significant chemical consumption and manpower required to operate the process. Additionally, the process generates a considerable amount of sludge that must be transported to an industrial landfill for disposal.

After interviewing other vendors, Valley Water decided to pursue an electrocoagulation process in conjunction with reverse osmosis membranes. The electrocoagulation process has the advantage of requiring less chemical use and generates significantly less sludge than the OPUS™ process. Electrocoagulation also destroys or removes most of the organic compounds in the water, including oil and grease, which eliminates a key foulant ahead of the reverse osmosis membranes and improves overall recovery. However, the electrocoagulation process does have the following drawbacks:

1. Not currently being commercially used at full scale in any California oil field,
2. Consumes more electricity than the OPUS process, and
3. Electrocoagulation unit contains metal plates that will corrode over time, thereby requiring replacement several times per year.

Despite these drawbacks, various vendors have made claims that electrocoagulation in conjunction with reverse osmosis membranes could reduce operating and capital costs by 50% or more as compared to the OPUS™ process, with the promise of less sludge and fewer employees to manage. With this in mind, and after conducting bench-scale tests on Edison water with several vendors, Valley Water selected two vendors to perform the pilot tests at Fee 34. These vendors were AGT Water Systems and ECT. The next section will describe the processes utilized by each of these vendors.

Section 3: Pilot Test Description

AGT's Pilot Test Facility

AGT's process consisted of the following technologies in series (Figure 3):

1. Induced gas flotation (free oil removal)
2. Walnut shell media filtration (suspended solids removal)
3. Electrocoagulation (organics removal and significant silica / hardness reduction)
4. Clarification (flocculation / sedimentation of contaminants removed by electrocoagulation)
5. Multi-media filtration (suspended solids removal)
6. Strong-acid ion exchange (hardness removal)
7. Single-pass reverse osmosis (total dissolved solids reduction)
8. Weak-acid ion exchange (boron removal)

The induced gas flotation unit removed the bulk of the free oil and grease from the water. Additional oil and grease and the majority of the suspended solids greater than 10 microns were removed in the walnut shell filter.

The electrocoagulation unit used electricity passed through a series of metal plates submerged in water to generate positively-charged ions in the water. These ions served as nucleation sites for negatively-charged or polar materials, such as organics, metals, and suspended solids, which coalesce into larger particles. Electrocoagulation works best when coupled with dissolved air flotation and a clarification unit, which helps lighter particles such as oil and grease float to the surface where they are skimmed off. Heavier particles settle to the bottom where they are scraped off and sent to a filter press for dehydration.

After clarification, the water was sent to multimedia filtration to remove any remaining particles, and then to strong-acid ion exchange to remove virtually all calcium and magnesium, which would have caused severe scaling in the reverse osmosis membranes.

The water was then sent through a single pass of brackish water reverse osmosis membranes, which removed the majority of salts and remaining contaminants from the water. Finally, the water flowed through a boron-specific ion-exchange unit, which removed the majority of the boron.

The flow rate for AGT's facility was approximately 11 gpm (340 bpd) in the electrocoagulation unit, and 2.5 gpm (86 bpd) through the media filter, reverse osmosis membranes, and ion exchange systems. The media filters, reverse osmosis membranes, and ion exchange systems were operated at greater than 90% recovery. For a 10,000 bpd facility, AGT estimated that the

overall recovery would be approximately 93%, which means that approximately 700 bpd of the feedwater would need to be disposed of as high salinity brine water. AGT also stated that 600 bpd of the brine water would be soft enough to use for regeneration of SAC (strong acid cation) softeners, such as those operated by nearby oil producers to soften produced water for steam generation. This beneficial use, if implemented, could drop the total rate of liquid waste to approximately 100 bpd, or 1% of the inlet rate.

With respect to solid waste, AGT states that a full-scale 10,000 bpd the facility would generate less than 0.1% solid waste by volume or approximately 2 cubic yards per day from a 10,000 bpd system. The solids would contain approximately 40% liquid by weight, and would be suitable for disposal as a non-hazardous material in a commercial landfill.

ECT's Pilot Test Facility

The decision to pilot the ECT technology was made only two weeks before the July 20, 2016 deadline for fielding a pilot facility. As a result, ECT had limited time in which to assemble essential components for treating the produced water at Edison Fee 34 and, therefore, ECT was unable to deploy certain equipment that would be essential for long-term reliable and cost-effective operation of a full-scale facility, such as water softeners and silica removal equipment. The lack of this equipment in the facility resulted in an exceptionally low recovery of just 60% for the reverse osmosis membranes.

Additionally, Valley Water granted ECT a waiver on a boron removal system due to the high cost and long delivery time for this equipment. However, despite the absence of this equipment, ECT was able to consistently meet the Effluent Specifications for all analytes with the single exception of boron.

ECT's process for the pilot facility consisted of the following technologies in series (Figure 4):

1. Electrocatalytic coagulation (catalytic oxidation – destruction of organics)
2. Dissolved air flotation (organics and free oil removal)
3. Multimedia filter (suspended solids and free oil removal)
4. 5 Micron bag filter (suspended solids removal – bypassed)
5. Activated carbon filter (remove any remaining organics)
6. Sodium hydroxide injection (not used)
7. Single-pass reverse osmosis (total dissolved solids reduction)

ECT has developed a variant of the electrocoagulation process. Instead of passing a high amperage of electricity across a series of submerged steel or aluminum plates to provide a source of positively-charged ions, their process instead uses “non-donating” anodes made of steel rods, coated with a proprietary blend of platinum, iridium, and other rare or precious metals. With the application of a low

current of electricity, this blend of metals purportedly catalyzes the polar molecules found in organic chemicals in the water, and essentially breaks them down into their elemental atoms of H, C, and O, which stay dissolved in the water. In this manner, their process does not produce a solid waste stream, and only a small amount of flocculant (primarily free oil) is recovered in a downstream flotation tank.

After organics removal, the water was sent to a multimedia filter to remove remaining free oil and suspended solids, and then to an activated carbon filter to remove remaining organic compounds.

The water was then sent through a single pass of brackish water reverse osmosis membranes, which removed the majority of the salts and remaining contaminants from the water.

The flow rate for ECT's pilot facility, including the multimedia filter, activated carbon filter, and the membranes, was approximately 20 gpm (690 bpd). However, as noted earlier, the reverse osmosis membranes were operated at a low recovery rate of only 60%, which resulted in an unacceptably high liquid waste stream of 40%. For a full-scale (10,000 bpd) facility, this would equate to a reject rate of over 4,000 bpd.

In a full-scale facility, an ECT system would include ion exchange softeners and cartridge filters to eliminate hardness and suspended solids upstream of the reverse osmosis membranes. ECT is also investigating various silica and boron removal technologies, including high pH nanofiltration membranes upstream of the reverse osmosis membranes, which would serve to reduce fouling on the membranes due to silica and suspended solids and increase recovery dramatically.

At this time, ECT is not able to provide accurate estimates of the daily volumes of brine and solid waste that would be generated by a full-scale facility, nor the amount of electrical power that would be consumed.

Section 4: Test Results

Valley Water contracted with Moore Twining Associates in Fresno, California to analyze produced and treated water samples for the pilot testing at Fee 34. Moore Twining provided the sample containers to Valley Water personnel with the proper preservatives inside, and all sample collection at the Fee 34 site was supervised and/or assisted by Valley Water personnel.

The samples were collected in containers that were carefully labeled, dated, and packed in ice in a reinforced Styrofoam cooler, and the cooler was mailed overnight to Moore Twining's facility in Fresno. All chain of custody protocols were followed. At the lab, in order to keep costs reasonable, Moore Twining was instructed to only analyze the water for the eight analytes listed in the table below. These analytes were believed to represent a reasonable range for evaluating the performance of the facilities for salts, boron, and the noticed Proposition 65 constituents.

AGT Pilot Test Results

The following table summarizes the average concentrations of key analytes for AGT, both upstream and downstream of the pilot facility:

Analyte	Units	Influent Produced Water (Average)	Effluent Specifications	Treated Water Discharge - Results of Grab Sample Analyses						Analytical Method
				8/10/16	8/23/16	9/7/16	9/14/16	9/21/16	9/22/16	
TDS	mg/L	3,700	500	83	230	330	430	430	89	SM 2540C
Sodium	mg/L	1,150	150	27	76	120	150	170	---	EPA 200.7
Chloride	mg/L	1,800	175	30	78	130	210	190	24	EPA 300.0
Boron	mg/L	9.9	0.5	ND	ND	ND	3.2	ND	0.04	EPA 200.7
Benzene	µg/L	14	1	ND	ND	ND	ND	ND	ND	EPA 8260B
Toluene	µg/L	2.2	150	ND	ND	ND	ND	ND	ND	EPA 8260B
Ethylbenzene	µg/L	ND	300	ND	ND	ND	ND	ND	ND	EPA 8260B
Naphthalene	µg/L	1.5	170	ND	ND	ND	ND	ND	ND	EPA 8260B

As can be seen, the effluent concentrations for the primary Proposition 65 constituents of concern, benzene, toluene, ethylbenzene, and naphthalene, were not detectable after treatment. AGT had one high value above the boron specification on 9-14-16, because the boron polisher was out of service for maintenance on the day the sample was collected. Otherwise, the effluent boron concentration was not detectable for the duration of the test.

The AGT pilot facility was operated continuously between five and seven days per week, ten hours per day since initiation. At this point, the process appears to be a technical success. However, more run time and additional water analyses over time are required before the technology can definitively be declared a technical success. Additionally, an autopsy on the membranes is required to conclusively determine the cause of membrane leaks that occurred during the pilot test and to check the efficacy of the pre-treatment regimen upstream of the membranes. The autopsy would help determine whether potential foulants and scalants were being removed sufficiently to allow reliable and sustained operation of the reverse osmosis membranes in a full scale facility.

ECT Pilot Test Results

The following table summarizes the average concentrations of key analytes for ECT, both upstream and downstream of the pilot facility:

Analyte	Units	Influent Produced Water (Average)	Effluent Specifications	Treated Water Discharge - Results of Grab Sample Analyses				Analytical Method
				8/23/16	9/7/16	9/14/16	9/14/16	
TDS	mg/L	3,700	500	120	110	86	88	SM 2540C
Sodium	mg/L	1,150	150	33	29	21	---	EPA 200.7
Chloride	mg/L	1,800	175	45	33	27	25	EPA 300.0
Boron	mg/L	9.9	0.5	7	6.7	4.9	5.8	EPA 200.7
Benzene	µg/L	14	1	ND	ND	ND	ND	EPA 8260B
Toluene	µg/L	2.2	150	3.4	1.3	0.55	ND	EPA 8260B
Ethylbenzene	µg/L	ND	300	ND	ND	ND	ND	EPA 8260B
Naphthalene	µg/L	1.5	170	ND	ND	ND	ND	EPA 8260B

ECT did not meet the goal for boron (which was set well below applicable Basin Plan requirements) because ECT was not required to provide boron removal equipment with their pilot facility, as discussed in the previous section. However, all Proposition 65 analytes were below the Effluent Specifications if not non-detectable.

The ECT pilot ran between five and seven days per week, up to ten hours per day since initiation; however, due to inadequate pre-treatment for hardness, silica, and suspended solids removal upstream of the reverse osmosis membranes, ECT only ran their membranes a fraction of the total test time to prevent fouling. In order for the ECT technology to be considered a technical success, boron, hardness, silica, and suspended solids removal must be incorporated into the process. Additionally, more run time, especially on the membranes, and an expanded suite of water analyses would be required.

Section 5: Projected Power Consumption, Operating Costs, and Reliability

Both AGT and ECT have produced similar results with slightly different technological approaches, mainly differing in their approach to removal of the organic materials. AGT relies on electrocoagulation, which uses a significant amount of electricity and results in the corrosion of steel plates over time, requiring replacement periodically. AGT's estimated power consumption for a 10,000 bpd full-size facility is estimated at 180 KW, or 0.43 kw-hr/bbl.

ECT utilizes an electrocatalytic coagulation technology, which uses less electricity and experiences very little anode degradation over time, but this technology also removes fewer foulants and scalants than electrocoagulation, and therefore places a greater load on downstream processes that must then deal with these contaminants. ECT claims their power consumption for a complete facility would be less than one with conventional electrocoagulation, but their power consumption value has not been verified.

Both AGT and ECT estimate that a 10,000 bpd full-scale facility would cost approximately \$0.15 to \$0.20 per barrel (\$1,160 to \$1,550 per acre-foot) to build and operate over a ten-year contract. These costs include labor, chemicals, electricity, electrode replacement, regeneration of IX units, replacement of membranes, and all other costs, with the exception of sludge and brine disposal, which would be the responsibility of Valley Water Management Company.

In terms of reliability, the majority of the equipment proposed for use by both vendors appears to be reliable and effective for treating produced water. The notable exceptions are the electrocoagulation / electrocatalytic coagulation processes and the reverse osmosis membranes (if operated at neutral pH as proposed).

It remains to be seen how reliable and cost effective the electrocoagulation / electrocatalytic coagulation processes would be in a full-scale facility. Although much of the cost risk would be borne by the vendor, the reliability risk would obviously negatively affect the oil producers supplying water to the Fee 34 Facility if the facility was unable to feasibly and cost-effectively treat water.

The AGT process has certain advantages by removing silica from the water, which is a potential non-reversible foulant in the reverse osmosis membranes depending on the concentration levels. The ECT process does not remove silica. The produced water silica concentration (as SiO₂) is 70 mg/L, which would likely limit ECT to running the reverse osmosis membranes at a recovery of 75% or less to avoid catastrophic silica fouling, unless ECT was able to economically adopt some as-yet undetermined form of silica removal into their process upstream of the membranes as discussed in Section 3. AGT in contrast expects to run their overall system with a recovery of 93%.

The ECT process, if successful, would have the advantage of significantly reduced maintenance on the electrocatalytic anodes as compared to a conventional electrocoagulation process.

At this point in time, Valley Water is not able to accurately predict the reliability (average run hours per year) of either system at full scale. A number of options can be considered to improve overall system reliability, such as backup injection wells and/or designing the facility to be larger than needed and providing local tank storage to enable the vendor to work down large volumes of accumulated produced water after facility outages.

Section 6: Economic Considerations

Advanced treatment of produced water at Valley Water Management's Fee 34 Facility poses serious economic considerations for the producers in the Edison Oil Field. The purpose of this section is to frame those considerations. This analysis is done in the context of produced water management at the Edison Field given the results of the pilot testing done to date and current oil market conditions.

The results of the pilot testing indicated that the operating costs for a 10,000 Bwpd capacity treatment facility would range from \$0.15 to \$0.20 per barrel (\$1,160 to \$1,550 per acre-foot) with a 75% to 93% water recovery rate, depending on the technology selected. This means that that between 7% and 25% of the feed water to such a treatment plant would require disposal as waste brine. However, the above facility operating costs do not include off-site disposal costs for brine. This brine stream would require truck transport to Clean Harbors or another permitted injection or disposal facility. If the trucking and brine disposal costs are included, the total estimated operating costs for a 10,000 Bwpd treatment plant would be as follows:

**Estimated Cost of Reverse Osmosis Water Treatment
Based on July-September 2016 Pilot Testing**

Operating Cost¹, \$/bbl	\$ 0.15	to	\$ 0.20
Op Cost, \$/year	\$ 547,500		\$ 730,000
Trucking Cost			
Overall recovery	93%	to	75%
Brine volume for 10,000 bwpd plant	700	to	2,500
Truck load volume	120	bbl/load	
No. of loads per year	2,129	to	7,604
Haul cost, per load ²	\$ 250	per 120 bbl load	
Haul cost, \$ millions per year	\$ 1,064,583	to	\$ 3,802,083
Est trucking cost/bbl	\$ 4.17	to	\$ 4.17
Waste Stream Disposal Cost³			
\$/bbl	\$ 10.50		\$ 10.50
\$/yr	\$ 2,682,750		\$ 9,581,250
Combined OpEx, Trucking, and Waste Stream Disposal Costs, \$/yr	\$ 4,294,833	to	\$ 14,113,333
Total Operating Cost, \$/bbl	\$ 1.18		\$ 3.87

¹ Includes labor, chemicals, electricity, electrode and membrane replacement, ion exchange regeneration, treatment skid.

² Quote from local hauler, October 2016.

³ Clean Harbors fee structure as of Oct '16.

As seen, the total operating cost would range from \$1.18 to \$3.87 per barrel (\$9,129 to \$29,999 per acre-foot).

The following table shows the annual volumes of oil and water produced from the Edison Field for the past 3 years. For every barrel of oil produced, an average of 14.6 barrels of water have been produced.

Water:Oil Ratio for Edison Field

Calendar Year	Oil (1)	Produced Water (2)	Water:Oil Ratio (3)
2013	791,298	11,974,586	15.1
2014	834,453	12,403,064	14.9
2015	747,547	10,372,775	13.9
3-Yr Average			14.6

Source: Edison Field, Kern County -- DOGGR Online Records

(1) Annual oil production, barrels

(2) Water volumes for year, barrels

(3) Ratio = (2) / (1)

To obtain the true operating cost for this treatment facility from an oil producer's point of view, the cost per barrel of water treated must be multiplied by 14.6 to obtain the equivalent cost per barrel of oil produced. This yields an operating cost range of \$17.18 to \$56.45 per barrel of oil. This range compares unfavorably to the revenue that would be generated by oil production associated with the water to be treated by this facility, especially when other field operating costs such as well maintenance, labor, electricity, taxes, etc. are considered. From an economic viewpoint, construction and operation of a water treatment plant of this capacity with reverse osmosis would not be economically viable.

Section 7: Conclusion

The pilot testing was completed at the end of September of 2016. At this point, both vendors substantially met the technical requirements of the May 2016 settlement agreement. However, before Valley Water can make a final determination as to whether either of these technologies would be technically acceptable at full scale, a much longer test period and post-test autopsies on the reverse osmosis membranes would be required in order to fully evaluate the reliability and operating costs for the technologies.

From an economic standpoint, the operating cost for a full-scale facility, including brine disposal, would likely range from \$1.18 to \$3.87 per barrel of incoming produced water. This equates to an estimated operating cost of \$17.18 to \$56.45 per barrel of oil produced with the water, based on a water-to-oil ratio of approximately 14.6 to 1. Operating costs in this range compare unfavorably with revenue from the associated oil production, especially when other costs of producing and selling the oil are considered. Therefore, from an economic viewpoint, construction and operation of a reverse osmosis water treatment facility of this capacity would not be viable, and is therefore unacceptable to Valley Water at this time.

This page concludes the text of the Report.

Tables

Table 1 – Effluent Specifications for Edison Fee 34 Facility

Parameter	Units	Limits
Benzene	µg/l	1
Ethylbenzene	µg/l	300
Toluene	µg/l	150
Naphthalene	µg/l	170

Figures

Figure 1 - Locations of Valley Water Management Company Edison Oil Field Facilities

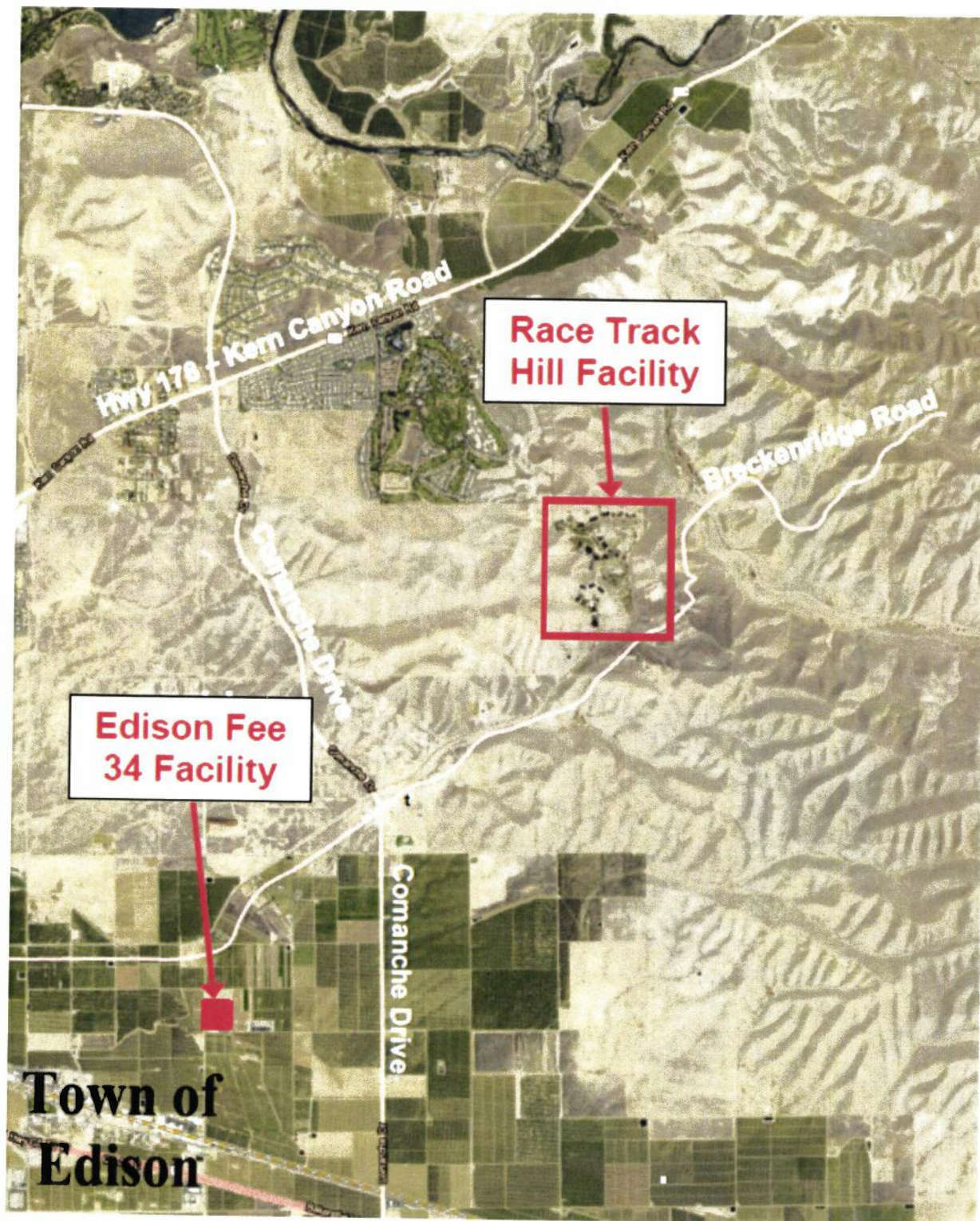


Figure 2 – Fee 34 Facility Layout

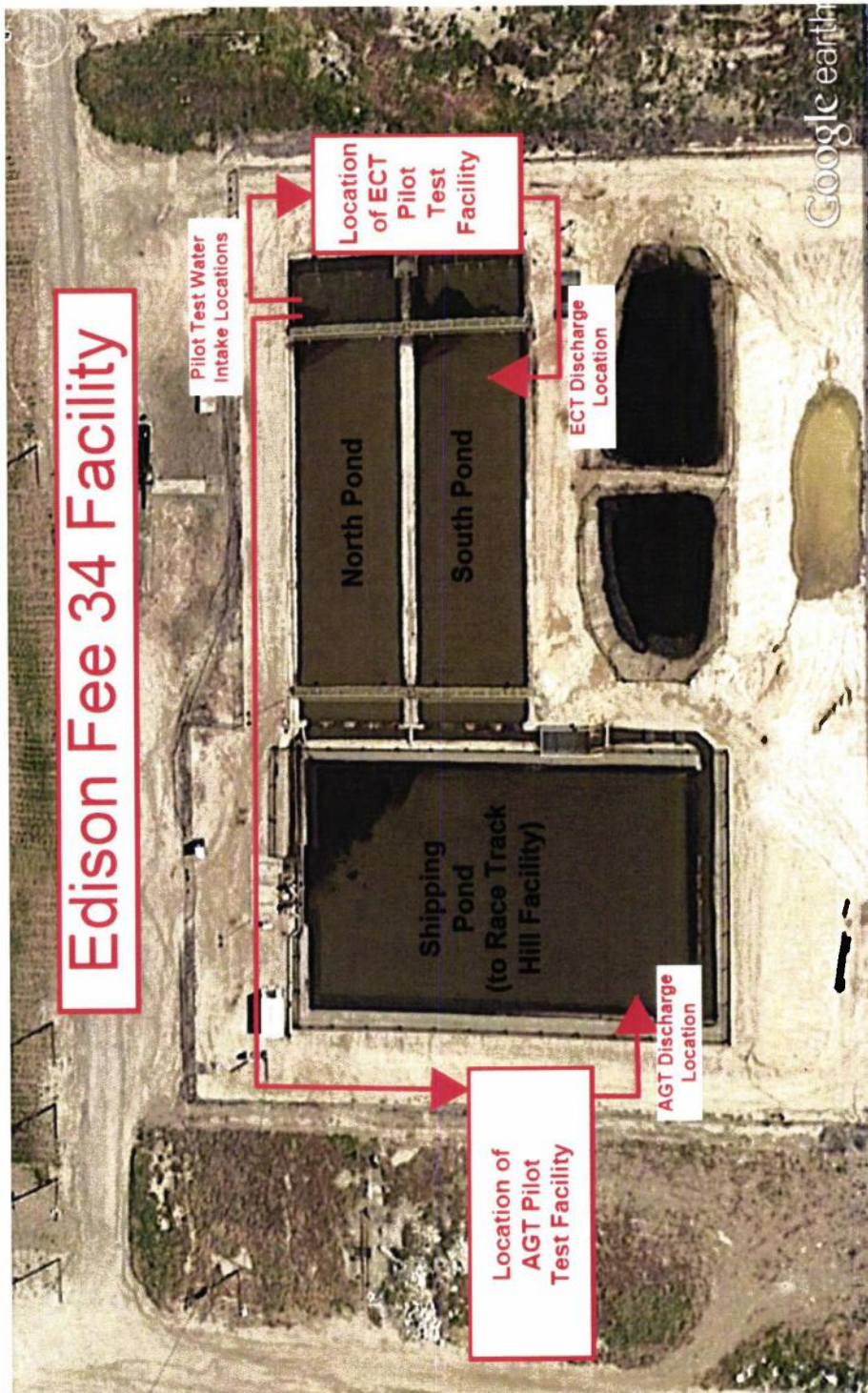


Figure 4 – ECT Pilot Facility Process Flow Diagram

